

Dental Care and Spread of Hepatitis B Virus Infection

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Sera from 576 healthy adults were tested for the hepatitis B surface antigen (HB_sAg) and antibody (anti-HB_s) to evaluate the role of routine dental care as a factor in the spread of hepatitis B virus (HBV) infection. Serological evidence of prior HBV infection, manifested by acquisition of anti-HB_s, was detected in 97 (16.8%) individuals, and 6 (1.0%) were identified to be asymptomatic HB_sAg carriers. The anticipated correlations of HB_sAg and anti-HB_s with age, country of birth, and socioeconomic status were observed in the study population. However, prevalences of both HB_sAg and anti-HB_s were inversely related to the lifetime total of dental care visits. These findings indicated that, in a region in which the HB_sAg carrier state and hepatitis B are prevalent, routine dental care is not identified as an important factor in the spread of HBV infection. While the results do not exclude the obvious possibility that cross-infections with HBV may occur during dental care in specific situations, they indicate that this mode of infection is exceptional.

The availability of sensitive tests for the hepatitis B surface antigen (HB_sAg) and antibody (anti-HB_s) has contributed significantly to our evolving understanding of the epidemiology of infection by the hepatitis B virus (HBV). In particular, inapparent parenteral infection ("nonparenteral") is now recognized to be an important epidemiological factor in both acute hepatitis B (14, 15, 33) and subclinical HBV infection (7, 19, 24).

The transmission of HBV infection without overt parenteral infection is often associated with intimate exposure to a contact in the household, a crowded children's institution, or a hospital, or with sexual activity (12, 19, 30). In the search for possible modes of cross-infection, HB_sAg has been detected in nearly all body fluids of HB_sAg carriers (23). However, epidemiological and serological evidence implicates saliva as the most probable vehicle for spreading HBV among contacts without apparent percutaneous exposures to blood products (34). Accordingly, attention has focused on the risks of infection by dental care, either as a result of patient-patient exposures by inadequately sterilized instruments or of dentist-patient exposures by intimate contacts with HB_sAg carriers (3, 8, 13, 17, 20, 21, 22, 26, 32).

An evaluation of the role of dental care in the spread of HBV infection in populations where high standards of dental care prevail is difficult because comparatively few individuals can be

identified with past histories devoid of dental care. Furthermore, in the United States, for example, the chances that a dental patient will follow a potentially infective HB_sAg carrier in the dentist's chair is on the order of 1 or 2 per 1,000, which is the prevalence of HB_sAg carriers in healthy blood donor populations (10). Thus, a prospective study designed to evaluate dental exposures to HBV would require not only a major population survey, but also several years of follow-up to evaluate seroconversion of subjects who did and did not have routine dental checkups.

On the other hand, isolated reports of outbreaks of hepatitis traced to exposures during dental care (17, 26) have contributed to a situation where health care administrators and legislators urgently need information to establish guidelines for the management of HB_sAg carriers and for the appropriate containment of HBV infection (1, 18). Blumberg (4), among others (18), has drawn attention to the stigmatized class of HB_sAg carriers, some of whom have left their health care jobs and others have changed their social behavior because of the fear that they might spread HBV infection.

The heterogeneity of the Israeli population provides an opportunity to study the role of dental care in the spread of HBV infection in a region known to have a high rate of clinically apparent (28) and subclinical (27) hepatitis B. The Israeli population can be divided with relative ease into high- and low-exposure groups with regard to dental care and, furthermore, the

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high regional HB_sAg carrier rate minimizes the number of subjects needed for evaluation in a preliminary survey.

The following report describes a seroepidemiological survey of anti-HB_s and HB_sAg in Israel, evaluating the relationship of past histories of dental care and serological evidence of HBV infection. Specifically, the objective of the study was to determine the role of dental care in the spread of HBV infection, as reflected by the acquisition of serological evidence of HBV infection in subjects with frequent, as opposed to infrequent, dental care.

MATERIALS AND METHODS

Population selection. The study population was selected from volunteer blood donors and dental clinic patients at the Hadassah-Hebrew University Medical Center, Jerusalem, with the objective of forming high-, intermediate-, and low-risk groups. The groups were defined by the lifetime total of dental care visits reported by the subjects during interviews and were verified, whenever possible, by reviews of dental clinic records. To minimize errors due to faulty recollections, the differences between the risk groups were maximized, classifying subjects according to 20 or more dental visits (high exposure), 10 to 20 visits (intermediate exposure), and fewer than 5 visits (low exposure). In practice, there was little difficulty in assigning a subject to these diverse risk groups. For purposes of the study, a dental care visit was defined as a clinical experience that involved the introduction of an instrument, a glove, or the dentist's hand into the patient's oral cavity.

The subjects were also classified by age, sex, past history of hepatitis, and country of birth. In Israel, an individual's country of birth has a recognized correlation with ethnic subgroup and is an indirect index of socioeconomic status. Accordingly, the geographic subgroups consisted of native Israelis, immigrants from Jewish communities of North America and Europe, and immigrants from communities in the Middle East (Yemen, Iraq, Iran) and North Africa (Libya, Algeria, Morocco).

Subjects were selected for the study group from consecutive blood donor and clinic registrations. Acquisitions were terminated when predetermined representations were achieved in each of the three risk groups ($N > 130$), as well as in each of the geographic and age subgroups ($N > 30$). The resultant study population consisted of 576 subjects, of whom 411 were males and 165 females and whose collective dental care experiences exceed 11,000 visits.

Since local regulations permit blood donations 5 years after recovery from viral hepatitis ("jaundice"), self-elimination of donors because of a past history of hepatitis was not considered to have introduced a significant bias in this region, compared with other regions in which a history of hepatitis is known to result in automatic exclusion (27).

Radioimmunoassays for HB_sAg and anti-HB_s. Sera were frozen at -20°C until tested by solid-phase radioimmunoassay for HB_sAg and anti-HB_s (Ausria-II-125 and Ausab, Abbott Laboratories, North Chicago, Ill.) by methods described previously (28). Sera

initially reactive for HB_sAg were retested for specificity by standard neutralization tests (Ausria Confirmatory Test, Abbott Laboratories).

Statistical analysis. The results of anti-HB_s tests were tabulated according to number of dental care visits by country of birth (Table 1) and age group (Table 2) and analyzed by the chi-square (χ^2) test. Because the proportions are small, the results of the tests for HB_sAg were analyzed for the differences between proportions using an approximation of the normal distribution, with a 95% level of confidence ($P < 0.05$).

Prevalence of HBV infection. The combined prevalences of HB_sAg and anti-HB_s provide an estimate of the total exposure to HBV in the study population. In this formulation, HB_sAg represents evidence of present infection (incubation, active disease, or carriage) and anti-HB_s represents prior HBV infection (clinical or subclinical) (27).

RESULTS

HB_sAg carriers. Of the 576 individuals tested, 6 (1.0%) were identified as asymptomatic carriers of HB_sAg (Table 1). This result is comparable to those of previous regional surveys reporting an HB_sAg prevalence of 0.97 to 1.8% (27,28). All six HB_sAg carriers were immigrants from North Africa or the Middle East and from the lower socioeconomic subgroup of the study population. Most significantly, five of the six HB_sAg carriers had individual lifetime totals of fewer than five dental care visits, indicating an inverse relationship of the HB_sAg carrier state and the number of dental care visits ($P < 0.01$).

Anti-HB_s. Of the 576 individuals tested, 97 (16.8%) had positive radioimmunoassays for anti-HB_s. The distribution of anti-HB_s in the study population was similar to that observed in a previous study of subclinical HBV infection in the region (27). Specifically, anti-HB_s was less prevalent among immigrants from North America (6.4%), intermediate for native Israelis (11.7%) and European immigrants (13.5%), and highest for immigrants from the Middle East (30.3%) and North Africa (43.8%) ($P < 0.001$) (Table 1). The prevalence of anti-HB_s increased with age through the fourth decade and was slightly lower in older adults (Table 2). The prevalences of anti-HB_s for males (17.8%) and females (14.5%) were not significantly different.

Of 34 individuals (6.0%) in the study group with a past history of hepatitis ("jaundice"), 5 (14.7%) had acquired anti-HB_s. Of the 542 individuals without a past history of hepatitis, 92 (16.9%) had acquired anti-HB_s. There is no significant difference between these two groups, confirming previous reports that icteric viral hepatitis in this region is not usually associated with serological evidence of HBV infection and is, presumably, the result of non-B viral infections (27).

TABLE 1. *Prevalence of anti-HB_s according to number of dental care visits and country of birth*

Country of birth	Total		No. of dental care visits					
			>20		10-20		<5	
	No. tested	Anti-HB _s , no. (%)	No. tested	Anti-HB _s , no. (%)	No. tested	Anti-HB _s , no. (%)	No. tested	Anti-HB _s , no. (%)
Israel	307	36 (11.7)	114	12 (10.5)	72	6 (8.3)	121	18 (14.9)
North Africa	73	32 (43.8)	15 ^a	3 (20.0)	12	6 (50.0)	46 ^b	23 (50.0)
North America	62	4 (6.4)	48	2 (4.2)	11	2 (18.2)	3	0 (0)
Europe	89	12 (13.5)	57	6 (10.5)	23	6 (26.0)	9	0 (0)
Middle East	45	13 (30.3)	17	6 (35.3)	13	2 (15.4)	15 ^a	5 (33.3)
Total	576	97 (16.8) ^c	251	29 (11.6)	131	22 (16.8)	194	46 (23.7)

^a Includes one HB_sAg carrier.^b Includes four HB_sAg carriers.^c Significance between geographic groups, $P < 0.001$.TABLE 2. *Prevalence of anti-HB_s according to number of dental visits and age*

Age group (years)	Total		No. of dental care visits					
			>20		10-20		<5	
	No. tested	Anti-HB _s , no. (%)	No. tested	Anti-HB _s , no. (%)	No. tested	Anti-HB _s , no. (%)	No. tested	Anti-HB _s , no. (%)
≤19	34	2 (5.9)	12	0 (0)	6	0 (0)	16	2 (12.5)
20-29	273	31 (11.4)	101	5 (5.0)	61	4 (6.6)	111 ^a	22 (19.8)
30-39	129	34 (26.4)	50 ^b	11 (22.0)	33	8 (24.2)	46 ^b	15 (32.6)
40-49	91	19 (20.9)	52	7 (13.5)	21	6 (28.6)	18 ^b	6 (33.3)
≥49	49	11 (22.4)	36	6 (16.6)	10	4 (25.0)	3	1 (33.3)
Total	576	97 ^c (16.8)	251	29 ^c (11.6)	131	22 ^c (16.8)	194	46 ^c (23.7)

^a Includes three HB_sAg carriers.^b Includes one HB_sAg carrier.^c Significance between dental visit groups, $P < 0.01$.

Most relevantly, the acquisition of anti-HB_s was inversely related to the number of dental care visits, being lowest for individuals with more than 20 visits (11.6%), intermediary (16.8%) for individuals with 10 to 20 visits, and highest for individuals with fewer than 5 visits (23.7%, $P < 0.01$) (Table 2).

Prevalence of HBV infection. When the prevalences of HB_sAg and anti-HB_s were combined to estimate the total exposure to HBV in the study population, there was an additional indication of the inverse relationship between dental care and serological evidence of HBV infection. The prevalence of HBV infection for subjects with more than 20 dental visits was 12.0% (30/251); for 10 to 20 visits, 16.8% (22/131); and for fewer than 5 visits, 26.7% (51/191; $P < 0.001$). A total of 103 subjects (17.9%) in the study population had serological evidence of either prior or present HBV infection (Table 2).

DISCUSSION

In other studies, acquisition of anti-HB_s has been related directly to the risk of exposure to

HBV, for example in patients with hepatitis B (2), multiply transfused patients (25), plasma fractionation workers (11, 31), hospital personnel (11, 16, 24, 29), and practicing physicians (9). In addition, seroepidemiological surveys have demonstrated that acquisition of anti-HB_s is correlated with advancing age, low socioeconomic status, and ethnic background, presumably as a consequence of the intensity and duration of inapparent exposures to HBV (6, 16).

In the present study, we have evaluated the acquisition of anti-HB_s in a geographic region in which the carrier rate of HB_sAg is approximately 10 times greater than that of the United States (10, 27). Accordingly, the risk of exposure to HBV from a contaminated dental unit or from an HB_sAg-carrier dentist is proportionately greater, as are the opportunities for observing and tracing modes of infection. Nevertheless, while the characteristic demographic correlations with HB_sAg and anti-HB_s were confirmed for the study population, serological evidence of HBV infection was not positively correlated with the number of dental care visits. On the contrary, HB_sAg and anti-HB_s were correlated with

lack of dental care, indicating that, at least in this epidemiological setting, routine dental care is not a major factor in the spread of HBV. The inverse relationship of anti-HB_s and the number of dental care visits is interpreted to reflect the economic classification of dental care as an expensive consumable, and therefore the frequency of dental care is an indirect index of socioeconomic status (5).

We conclude that prior exposure to HBV, resulting in acquisition of anti-HB_s, is a relatively common event in this population (16.8%), and the frequency is even slightly higher (17.9%) when past and current HBV infection are included. The modes of exposure to HBV in populations are varied and may be correlated with socioeconomic status, advancing age, occupational exposure, and intimate personal contact with HB_sAg carriers. In exceptional individual cases, dental care may provide the necessary intimate setting for cross-infection by HBV (17, 26). However, routine dental care is not identified in this population to be an important factor in the spread of subclinical HBV infection and the acquisition of anti-HB_s.

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